ORIENT ABRASIVES LTD

Draft Report on: EIA/EMP for the Mining of 2,75,850 TPA ROM of Bauxite at Kothariya Mine located at Survey No. 330/P, Village Mewasa, Taluka Kalyanpur, Jamnagar District, Gujarat

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Environmental Consultants
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Environment for Development

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QUALITY CONTROL							
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Cover Page: Working in a mining lease area, view of Marine National Park within study area, flora observed in study area, fauna observed in study area

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ABBREVIATIONS

CPCB	:	Central Pollution Control Board
DG	:	Diesel generator
DGMS	:	Directorate General of Mine Safety
DMP	:	Disaster Management Plan
EHS	:	Environmental Health and Safety
EIC	:	Environmental Information Centre
FAEs	:	Functional Area Experts
GLC	:	Ground Level Concentration
GPCB	:	Gujarat Pollution Control Board
HSD	:	High Speed Diesel
IBM	:	Indian Bureau of Mine
IMD	:	Indian Meteorological Department
LOI	:	Loss of Ignition
MM	:	Modified Mercalli
MMR	:	Metalliferous Mines Regulation
MNP	:	Marine National Park
MoEF	:	Ministry of Environment and Forest
MRL	:	Meter Reduced Level
MT	:	Metric Tonne
OAL	:	Orient Abrasives Limited
OB	:	Over Burden
PDCR	:	Plan, Do, Check and Review
PM	:	Particulate Matter
PPE	:	Personnel Protective Equipment
PWD	:	Public Work Department
REIA	:	Rapid Environmental Impact Assessment
ROM	:	Run of Mine
RSPM	:	Respirable Suspended Particulate Matter
SPM	:	Suspended Particulate Matter
TPH	:	Tones per Hour
USEPA	:	United States Environmental Protection Agency

EXECUTIVE SUMMARY

1.1 Introduction and Background

1.1.1 General Information

M/s Orient Abrasives Limited (OAL) was established as a venture to manufacture calcined and fused alumina products in 1974, in technical collaboration with Karborundum, Bentueky, Czechoslovakia, by the Rajgarhia Group of Industries. OAL is a multi-divisional company having their head office at New Delhi, manufacturing facilities at Porbandar (Gujarat) and Bhiwadi (Rajasthan) and distinction of being ISO - 9001 (Quality Management System) certified. The Company offers a wide range of refractory and monolithic products for the iron and steel industry and enjoys a large domestic and international clientele. An in-house R&D facility supports the division's product development initiatives.

1.1.2 Project background

The focus of this study report is the Kothariya bauxite mining lease of OAL in Mewasa Village of Kalyanpur Taluka of Jamnagar District, Gujarat State. Total area of the mining lease is 62.32 ha.

Location and Approach to Site

Kothariya mining lease is located at survey number 330/P of Mewasa village and can be approachable by Ran village by the means of village road. Ran village is located at a distance of ~1 km from the road connecting Limbdi to Dwarka and is known by State/Coastal Highway 6 (CH-6). This CH-6 is then terminates into the Jamnagar-Okha State Highway 25 (SH-25).

1.2 Project Details

1.2.1 Reserves

Quantitative Estimation of Reserves

In all 19,49,930 MT geological reserves of proved category have been calculated in the approved modified mining plan. Out of these 13,95,792 MT were considered under mineable reserves because some of the reserves remain blocked up under statutory barrier and final benches. During the modified plan period of two years, lessee exploited bauxite to the tune of 1,21,571 MT.

In the same mining plan, reserves were calculated by Plan Area Method, considering bauxite zone with a thickness of 4.50 m. The specific gravity was taken as 2.5. At that time, recovery of bauxite was considered as 70%, but in actual it was observed that the recovery is 75%, thus the recoverable reserves were revised accordingly. Summary of reserves present is given in ***Table 1.***

Table 1: Summary of Reserves Estimation

Area	Proved Category (Category 111) (MT)	Probable Category (Category 121) (MT)	Possible Category (Category 123) (MT)	Total (MT)
62.32 ha.	19,67,639	Nil	Nil	19,67,639

1.2.2 Mining Details

Method

Mining will be carried out by semi-mechanized open cast method (using excavators and tippers) in which soil will be scrapped first and stacked nearby. Then, limestone and bauxite with depth upto 1.0 m and 4.50 m respectively will be excavated by forming one bench for each, keeping the width of benches 10 m. The bauxite horizon is thick and thus drilling and blasting will be used during mining.

For the given scheme period mining will be started from the south and central part of the lease, advance in north-east direction covering an area of 12.11 ha with a working depth of 6.1 m.

Production Details for Scheme Period

During this scheme period of five years total 13,62,150 tonnage of ROM will be excavated out of which recovery of bauxite will be 10,21,612 MT (75% of ROM). Details of yearwise production of bauxite and overburden are presented in ***Table 2***.

Table 2: Yearwise Production Details for Scheme period

Year	Volume (m^3)		Tonnage of ROM (MT)	Recovery of Bauxite 75% of ROM (MT)	Waste 25% of ROM (MT)	Production of Bauxite	
	OB	ROM				Plant Grade (10% of Prod.)	Non-Plant Grade (90% of Prod.)
2009-10	38496	108270	270675	203006	67669	20301	182705
2010-11	9864	108000	270000	202500	67500	20250	182250
2011-12	5048	108900	272250	204188	68062	20419	183769
2012-13	11600	110340	275850	206887	68963	20689	186198
2013-14	6150	109350	273375	205031	68344	20503	184528
Total	**71164**	**544860**	**1362150**	**1021612**	**340538**	**102162**	**919450**

The above activities will be extended till the end of the mine life, i.e. two more years, assuming the same rate of mining. Lease period expiry is by 2021.

Stacking of Mineral Rejects and Disposal of Waste

As per the proposed mining scheme, OB and waste generated will be backfilled in the mined out voids in the southern part of lease area, therefore, the problem of disposal of OB and waste will not be there. The soil scraped will be spread over the backfilled area. Details of backfilling are presented in ***Table 3***.

Table 3: Details of Backfilling

Year	Area proposed to be mined out (m^2)	Volume of Total filling material (m^3)	Area to be Backfilled (m^2)	Avg. Depth of Backfilling (m)
2009-10	24,060	77,113	14,020	5.5
2010-11	24,000	39,823	7,240	5.5

Year	Area proposed to be mined out (m^2)	Volume of Total filling material (m^3)	Area to be Backfilled (m^2)	Avg. Depth of Backfilling (m)
2011-12	24,200	33,787	6,143	5.5
2012-13	24,520	42,665	7,757	5.5
2013-14	24,380	35,341	6,426	5.5
Total	**1,21,160**	**2,28,729**	**41,586**	**5.5**

The above activities will be extended till the end of the mine life, i.e. two more years, assuming the same rate of mining. Lease period expiry is by 2021.

Sub – grade Material Handling

In the proposed mining there is no possibility of production of sub-grade ore, hence there is no provision made for stacking of it.

Mineral Reject Handling

The mineral rejects generated will be lifted to an extent and after blending with high grade bauxite purchased from other lease holders, will be exported for cement manufacture.

Employment Generation

The lessee is having several mining leases in this area and has employed qualified mining engineers and geologists for of these works under the Regulation 42(1)(a) of MCDR 1988. Total 47 persons will be involved in Kothariya bauxite mining lease (including temporary or permanent).

Mineral Beneficiation

The different grades of bauxite occurring in this lease are associated with laterite and clay. Except manual sizing and sorting of the bauxite no other processing is proposed to be done.

1.2.3 Water and Wastewater

Water Requirement

Total water requirement of the project is 11 KLD, which is mainly required for dust suppression, greenbelt development and for domestic use. Water will be supplied by the means of tanker from the well present in Mewasa village.

Wastewater Generation

There will be no wastewater generation from mining activities; however, 1.69 KLD of domestic wastewater will be generated, which will be disposed in soak pits.

1.2.4 Mine Drainage

Ground Water

The bottom of the quarry remains much above the ground water table and during mining water table will not be intersected by working, thus there is no point related with the mine drainage.

Storm Water

The rain water will get collected in the mined out pits and as a common practice is used by the mine owners for dust suppression and greenbelt development.

1.2.5 Air Emissions

Point Source Emissions

There are no D.G Sets installed for the process of mining, hence emissions of Particulate Matter (PM_{10}), Sulphur–di-Oxides (SO_2), and Oxides of Nitrogen (NO_X) will not occur from these sources. Marginal emissions will be there because of:

- Diesel consuming equipment such as earth movers, jack hammers and compressors used for drilling blast holes
- Dewatering pump (operated as and when required for short periods of time) for removing water after rains from pits that have not been completely mined out.

Area Source Emissions

Area source emissions in the form of particulate matter (PM) are likely to occur due to:

Open pits generated during mining operations, and
Dumps of mined out materials, due to wind

Line Source Emissions

During movement of vehicles dust emissions will be generated and this has been considered in the modeling exercise.

1.2.6 Utilities Required

Electricity

There is no electric supply (existing or proposed). The mine works in one shift (i.e. general shift) only, so no lighting arrangements will be required.

Fuel: Diesel

High Speed Diesel (HSD) is used for running equipment including earth moving equipment (excavators and tippers) compressors and water pumps and transport vehicles.

Explosives

As mentioned earlier, blasting will be required for the mining activities. However, explosives will not be stored at the mine site during mining operations. They will be stored and supplied from OAL's existing central facility at OBM I mine site.

Transportation of explosives will be done by the supplier up to mobile magazine i.e. the central facility at OBM I site, by explosive van of the supplier. When it is required for mining purposes, explosives will either be transported by bullock carts, or manually, in DGMS approved wooden boxes.

1.2.7 Programme of Afforestation

In the IBM approved mining scheme, it is proposed to carry out afforestation on backfilled area with a rate of 100 saplings / year. Additional plantation proposed is mentioned in the Environmental Management Plan.

1.3 Environmental Setting

1.3.1 Study Area

The study area is considered to be the mining lease area, and an additional area of 10 km radius from the lease boundary.

1.3.2 Climatology

As per the Indian Meteorological Data (IMD) the climate in the region shows broadly four seasonal variations, namely:

Winter	: December - February
Summer	: March – May
Monsoon	: June - September
Post-monsoon	: October - November

The area remains cloudy between June - September, which is the active period of the monsoon season. Generally cloud cover ranges from 6 to 7 OKTAS during this monsoon season. In the winter season cloud cover is predominantly 0 OKTAS and on occasions goes up to 6 to 7 OKTAS, with significant readings in the 1 to 5 OKTAS range.

1.3.3 Study Period

The study period was the winter season (December 2012 – February 2013).The predominant wind directions during the study period were observed to be from North and North-East, split almost equally.

1.3.4 Ambient Air Quality

Sampling was carried out at 8 locations, representing areas where maximum impact due to air emissions is likely to be felt, nearby villages and sensitive receptors. Efforts were made to cover the study area equally, as well as those areas where higher levels of air pollution are likely due to existing operations in the study area. Sampling details and results are as follows:

- The frequency of monitoring was 24 hrs twice a week at each station, spread over the season, with gaseous samples being changed six times (at 48-hour intervals).
- The parameters monitored were PM_{10}, Sulphur Dioxide (SO_2), and Oxides of Nitrogen (NO_X).
- SO_2 and NO_X readings are well within limits. PM10 results were also found to be within limits. However it was noted that the readings were significantly lower than the prescribed standard ($100ug/m^3$) at all locations except in proximity to the common haul road used by trucks ferrying minerals from different mines. A station was set up near Ran Village, for sampling of ambient air quality near the haul road at the request of the Village Sarpanch.

1.3.5 Land

Land use within the study area was determined with the help of satellite image and classified into relevant categories such as habitation, saline area, mud flats, beach area, water bodies, land without scrub, land with scrub, agricultural land, rocky area, sandy area, mining area, and salt pans. Land use maps of the area we prepared based on the land use map prepared by Institute of Remote Sensing, Anna University, Chennai.

1.3.6 Water Quality

Surface water quality

The main sources of surface water (other than the sea) within the study area are village ponds, catchment areas of check dams, village wells (belonging to villages as well as privately owned) and dug out pits within mine sites filled with rain water. A cross-section of samples was taken to represent all these sources. Accordingly, surface water samples were collected from 6 locations namely: back waters of the Mota Asota check dam, a dug out mine pit at OAL's Nandana Site, Pindara Village pond, Mota Asota (marine sample), Pindara (marine sample) and Near Mewasa village. Analysis of the parameters revels that most of the parameters at all locations are below the permissible limits, except few.

Ground water quality

Groundwater samples were taken from a dug well near the mine site and at 8 villages namely: Mahadeviya, Pindara, Juvanpur, Mota Asota, Mewasa, Habardi, Ran and Nandana. The samples were analyzed for parameters specified in the EIA Manual. For comparison the parameters were compared with the BIS Drinking Water Standards (BIS: 10500 – 1991) where these are specified in those Standards.

A summary of the presented results indicates that:

- Ground water near the mine site, Mewasa and Ran village exhibit high TDS,
- Sulphates contents are found to be high at Mewasa, Ran and Nandana villages,
- chlorides contents are found to be high at Mewasa and Ran villages,
- Total hardness and Magnesium is found to be high at Mewasa, Ran and Nandana villages

1.3.7 Noise

Noise level monitoring was carried out at 8 locations, namely; four at site, Mewasa village, Ran village, near MNP, and near Albai Mataji Temple.

1.3.8 Flora Fauna

In order to collect information about the flora and fauna of the study area, a survey was conducted by the ecological team of Kadam and the data is taken from the Department of Marine National Park (MNP) and Department of Environment, Jamnagar.

1.3.9 Soil

Soil samples were collected from 9 different locations, namely: near GLC area, Mota Asota village, at site, Ran village, Sidhsara village, Gurgad Village, Nandana village, Habardi village and Bhatia. Soil sample at site contains 41.56% sand, 30.28% clay and 28.16% silt and gives texture of clay loam. The sample is slightly acidic in nature with a pH of 7.62, with porosity and water holding capacity of

58% and 74.7% respectively. The cation exchange capacity and electrical conductivity is 20.80 mg/100kg and 185.50µmoh/cm respectively.

1.3.10 Population of the Study Area

- The statistics regarding the human population and the number of dwelling units of villages in the study area is sourced from the Census of India, 2001.
- There are 13 villages in the study area.
- On this basis, the population of the study area is estimated to be 32,811 in the study area (i.e. within 10 km from periphery or approximately *357.65 km*^{2}) giving a population density of about *~92 persons/km*^{2}.

1.4 Impact Assessment

1.4.1 Topography and Drainage

The mining lease area is relatively a flat terrain having a low slope with a general slope from north-east to south-west direction. In the present mining scheme 12.11 ha of land gets degraded with a working depth of 6.1 m, out of which 4.15 ha of land will be backfilled and rest will be used as water reservoir. During coming 7 years the entire lease area leaving the statutory barrier will be converted into one single pit. The mining activity will not affect the topography in a broad way because total reject produced during mining is proposed to be used for backfilling.

The bottom of the quarry remains much above the ground water table and during mining water table will not be intersected by working, thus there is no point related with the mine drainage.

1.4.2 Ambient Air

- Detailed average readings indicate at all air ambient station PM_{10}, SO_2 and NO_X are within the prescribed limit of CPCB for respective categories. However it is noted that the Ambient Air Quality at Ran Village (along the road used for transporting of bauxite from mines) is significantly higher than other areas in the study area, owing to the movement of trucks and absence of *pucca* road in that stretch.
- The 98th percentile value for concentration of PM_{10} in the ambient air at all locations is within limits.
- Low concentrations of SO_2 and NO_X at all locations.
- The average reading at Kothariya mine site is observed to be 87µg/m^3 owing to the present mining activities. In order to reduce the air pollution, it is proposed to develop greenbelt along the statutory barrier as well as in the backfilled area as reported in EIA report.
- For pit source emission, the maximum 24 hours GLC within Kothariya mine is estimated to be 9.69µg/m^3. The GLC is expected at a distance of 500 m form the mine in South direction.

1.4.3 Land

Land degradation is one of the adverse impacts of mining in the form of excavated voids and also in the form of waste dumps. The mining lease area is relatively a flat terrain. At the end of five year plan period, out of total 62.32 ha of area, mining will be carried out only in 12.11 ha i.e. 19.43 % of area will be degraded with a depth of 6.1 m. Out of this degraded area 4.15 ha of area will be backfilled and used for greenbelt development, whereas rest of the area will be used for water reservoir. In the water reservoir the higher benches of excavated mining pit shall be terraced and plantation will be done for stabilization of slope. The slope of higher benches will be made gentle for easy accessibility by local people to use water and fencing will be carried out around the reservoir.

1.4.4 Water Quality

Ground Water Quality

Ground water in the area is saline in general and salinity increases with passage of time after monsoon as the water level goes down. Good monsoon is rare in the region and drought condition is a common phenomenon in the area. On account of this, the region is devoid of any perennial river. Due to scanty and unpredictable rainfall, there is acute scarcity of ground water. As per the IBM approved mining plan, the water table in the area is 12 m below the general ground level during the monsoon. The mining excavation will never touch the ground water table. Even at the ultimate stage the pit will be of shallow depths of about 6.1 m, which is above the water table. Thus, there is no likelihood of intersection of water table. So no adverse impact on ground water is anticipated due to mining activities. Using of stored water in pits (normally available upto February) for the purposes of sprinkling on roads conserves use of fresh water for the purpose.

Surface Water Quality

Management of Mining Activities to Reduce Stacking of Overburden and Wastes

OAL proposes to store the water in the mined out pits during the next five years of mining and will not dispose-off the drainage in surface water bodies nearby the lease area. In addition to this, the material comes out as waste during mining will be backfilled within a short time of its generation, thus reducing the probability of its stacking which in turns reduces the chances of drainage of this material with rain water.

Likelihood of Transport of Materials from Mine to the Marine National Park

The nearest surface water body is in the form of the catchment resulting from the check dam constructed on the Rani River, lying ~1.1 km to the NE of the nearest boundary of the mine. Here the potential gradient of the first order stream, located outside the mine lease is ~1:65 and the second order stream (Rani River) is ~1:800, indicating a gentle slope that will not carry the sediments far. The flow of the Rani River is further controlled by the presence of a check dam, after which the river flows into the sea.

The mine lies at a distance of 7.21 kms from the MNP. Management of mining activities so as to control stacking of mine wastes, the shallow slope of the main river flowing to the sea and the presence of the check dam prior to the river flowing into the sea, all ensure that material from the mines is extremely unlikely to flow into the sea and cause any impact whatsoever on the MNP. This fact is also corroborated by the Draft MNP Eco-Sensitive Management Plan that demarcates the eco-sensitive areas to a short distance (between 1.0 – 1.5 km from the edge of the MNP).

1.4.5 Noise

The impact due to blasting noise in the nearest habitation from Kothariya mining site, i.e. at Mewasa village at a distance of ~2330 m, is not going to be significant because the time duration for which the noise level is going to rise is very limited, i.e. up to a few minutes in the whole day. Mewasa village will receive noise level of 58.36 dB (A) for a very short duration of blasting, and hence the Time-averaged sound pressure level during the day is not likely to be affected by more than 3-4 dB(A) because of blasting.

The allowable exposure time for 85 dB(A) of Noise Level for a human ear is up to 8 hrs, i.e. if a human is exposed to less than 8 hours of continuous noise dose at 85 dB, it is not going to cause any

permanent hearing damage, and hence the Noise Levels predicted in the respective villages surrounding the site are well within the limit.

Further, during blasting, all precautions will be taken for minimizing noise and vibration like optimum charge per delay, various controlled blasting techniques etc. Blasting will be carried out once in a day, for very small duration, i.e. for few seconds only. Muffling will be adopted to reduce the impacts of blasting. All PPE's will be provided to the persons working during the blasting.

1.4.6 Ground Vibrations

Ground vibration modeling is carried out by using the USBM empirical equation, and it is observed that, the maximum charge per delay will be 6.25 kg explosive/delay. In Mewasa village at a distance of ~2330 m from the lease, the ppv value was calculated as 0.02 mm/sec against a limit of 5 mm/sec. Ground vibration will be felt only at the time of blasting and so these vibrations will be only for few seconds per day.

1.4.7 Fly Rock

Fly rock calculations due to explosion have been modeled using USBM's vertical face fly rock model for two different break-out angles i.e. 45° and 90°. Maximum fly rock distance obtained was 320.33 m at a break out angle of 45°, with lower distances for other break-out angles.

A no-blasting zone will be enforced within the mine to ensure that blasting is carried out at a safe distance from the nearest habitated areas.

Flora Fauna

The baseline study, for the evaluation of the floral and faunal biodiversity of the terrestrial environment of the study area, within 10 Km radius from the proposed mining lease has been conducted during January 2013 and it has been observed that the major vegetation has to be cleared will be only few thorny shrubs of *Euphorbia nivulia, Prosopis juliflora*, which are scattered all over the mining lease area. No trees were observed in the lease area. The mining site is surrounded by few agriculture fields, the major crop practiced in this region are Cotton, Ricinus and Wheat. The study area is characterized by the mostly plain area and undulating terrain with small hillocks. Few of these hillocks were with a good population of *Commiphora wightii* (Gugal), which is intermingle with the thick bushes of *Euphorbia nivulia*.

No natural forest area as such was observed with in the 10 km radius from Mewasa village; except few scattered mangrove vegetation of *Avicennia marina*, observed along the sea coast of Pindara village, Virpur village and Nana Ashota village of the study area

The roadside and hedge vegetation was dominated by plants like *Solanum indicum, Abutilon indicum, Opuntia elator, Calotropis giganatea, Clerodendrum phlomoides etc.*

The thorny scrub vegetation is the characteristic inland region of the study area, which includes *Prosopis juliflora, Salvadora oleoides, Salvadora persica, Zizyphus nummularis, Calotropis procera, Capparis decidua, Acacia jacquemontii, Acacia nilotica, Acacia senegal, Maytenus emarginata, and Balanitis aegyptica.*

The tree population was very less in this part of Jamnagar district. The dominant trees growing in this area are *Prosopis cineraria, Acacia nilotica, Acacia leucophloea, and Azadirachta indica*.

For the documentation of the faunal biodiversity of the study area with respect to birds, reptiles, amphibians, and butterfly species, a detailed survey had been conducted, within 10 km radius from proposed site.

1.4.8 Soico-Economic Conditions

The study area is comprises of 13 villages out of which 10 are in Kalyanpur Taluka and remaining 3 are in Khambhaliya with a total population of 32,811 in which around 21.6% i.e. 7,097 are residing in the core area (0-3 km).

The project is on government wasteland, so resettlement and rehabilitation is not required. Therefore, compensation for the land shall not be applicable.

The mining activity will have both beneficial and adverse environmental impacts related to socio-economic in the study area.

Positive Impacts

The mining activity would generate employment opportunities for both skilled and unskilled people.

Several vehicles/equipments like tractors & trolleys, bulldozers, excavators shall be hired from the nearby villages hence giving business opportunities to the local people.

The living standard of the people will become better with increase in earning opportunities.

Negative Impacts

- The approach road to mine is cart track. There may be wear and tear of the roads connecting the villages specially during monsoon season due to movement of heavy vehicles i.e. truck, tractors and bull dozers, jeeps etc.
- The mining dust may have negative impact on the health of local people living in the surrounding areas.
- The dust generated during mining activities can affect the adjacent agricultural fields.
- There is probability for the loss of small patches of agricultural land due to generation of dust from the nearby mines.

Mitigation Measures

- Construction and maintenance of the roads connecting the mines and villages at regular interval by the project proponent
- Monitoring of Air, Water and Noise will be carried out as agricultural fields are just found adjacent to the site.

1.5 Environment Management Plan

The detailed environment management plan is provided in ***Table 4***.

Table 4: Environment Management Plan

Sr. No.	Stages	Key Issues during Mining	Impacting Activities	Mitigation Measures	Final Impacts
1	Site Clearing	Water use & Quality	N.A	It is an existing site, no water required for clearing	No Impact
		Wastes	Solid waste generation due to removal of vegetation (mostly species of Ganda baval)	Area confined for mining is already clear as it is a working mine, vegetation present is not much	Negligible Impact
		Hazardous material	N.A	No use of hazardous material	No Impact
		Land use & Biodiversity	Removal of vegetation on the site.	As discussed above not much vegetation is present and area confined for mining is already cleared Moreover, OAL plans to do plantation at the end of mining	Negligible Beneficial Impact
		Air Quality	Dust emission	Equipment used for site clearing shall be sharp to minimize air pollution. Provision of spraying water to reduce dust emission.	Negligible Impact
		Noise & Vibrations	Noise will be generated due to movement of vehicles and equipments	As stated earlier it is an existing mine and already cleared and not much site clearing is required	No Impact
		Energy use	Use of equipment & vehicles during clearing	Not much clearing is required as mining area is already cleared	No Impact
		Visual Impacts	Mining involves formation of voids with depth of 6.1 m	Part of mined out void will be backfilled and used for plantation and rest will be used as water reservoir	Negligible Negative Impact
2	Operations	Water use & Quality	At site OAL will use limited amount i.e. 11 KLD of water for mine. Water will be used for: Dust suppression Domestic/Drinking Greenbelt Development	Water will be taken by the means of tanker from nearby well present in Mewasa village, Along with this water stored in mined out pits will also be used for dust suppression to reduce dependency on ground water, Sewage generated will be disposed off in soak pits.	No Impact on Groundwater & Quality

Sr. No.	Stages	Key Issues during Mining	Impacting Activities	Mitigation Measures	Final Impacts
		Wastes	As per the mining plan overburden and waste will be generate during mining operation.	The overburden and soil waste generated will be backfilled in the mined out areas.	Negligible Impact
		Hazardous material	Blasting will be carried out during mining, nitrate mixture will be used	Blasting will be done during resting hours and proper care will be taken	Negligible Impact
		Land use & Biodiversity	Creation of pits during mining operations. Removal of vegetation (species of ganda baval)	The mining pits will be backfilled at the end of mining. The backfilled area will be covered by plantation. The open voids will be properly barricaded to prevent accidental fall.	Negligible Negative Impact
		Air Quality	Dust emission due to mining activities like, blasting, drilling, use of compressor, vehicular movement, & use of dewatering pump (if required)	Provision of spraying water to reduce dust emission. Equipment used shall be sharp to minimize air pollution	Negligible Negative Impact
		Noise & Vibrations	Activities like movement of vehicles, drilling, use of compressor etc, and blasting	Noise from vehicles will be avoided to the extent possible. Equipment used shall be sharp to minimize noise pollution. Ear muffs and other PPE's will be provided to the workers	Noise: Negligible Impact, Vibration: Negligible Negative Impact
		Energy use	Transport, drilling, blasting, crushing, and pumping.	Will be reduced as much as possible	Negligible Impacts
		Visual Impacts	Formation of Voids due to mining, Blasting	Mined out voids will be partially backfilled & use for plantation, rest will be water reservoir	Negligible Impact
3	Blast Hole Drilling	Water use & Quality	Not Applicable	-	No Impact
		Wastes	Solid waste will be generate during drilling	Waste generated will be backfilled	No Impact

Sr. No.	Stages	Key Issues during Mining	Impacting Activities	Mitigation Measures	Final Impacts
		Hazardous material	Not Applicable	-	Negligible Impact
		Land use & Biodiversity	Holes will be drilled per day with a depth of 1.5-2.0 m.	-	Negligible Impact
		Air Quality	Emission of dust particles during drilling.	Sharp instrument will be used for drilling holes to 4.5 m. Wet drilling method will be used Driller will be provided all PPE's like dust masks, ear muffs etc.	Negligible Impact
		Noise & Vibrations	Jack hammer and compressor will be used during drilling.	OAL has already adopted innovative approaches of using improvised plant and machinery design with in-built mechanism to reduce sound emissions like improved silencers, mufflers and closed noise generating parts. Specifically, noise from compressors will be minimized by sound maintenance of the equipment and by providing enclosures. Personnel operating the compressors will be provided all the PPE's. Holes are drilled towards free face only	Negligible Impact
		Energy use	Jack hammer and compressor will be used during drilling.	Sharp equipments will be used to avoid wastage of energy loss as much as possible	No Impact
		Visual Impacts	Drilling of blast holes upto a depth of 1.5-2.0 m	-	No Impact
4	Blasting	Water use & Quality	Not Applicable	-	No Impact
		Wastes	Generation of solid waste due to blasting in form of stones and fly rock. Fly rock is caused by a mismatch of the	Considering factors such as burden, spacing, hole diameter, stemming, sub drilling, initiation system and type of explosive used should match the rock	Negligible Negative Impact on Land

Sr. No.	Stages	Key Issues during Mining	Impacting Activities	Mitigation Measures	Final Impacts
			distribution of explosive energy, confinement of the explosive charge and mechanical strength of the rock.	formation. Essential parameters such as diameter, depth, sub drilling, burden, spacing and angle of holes are clearly communicated to the driller.	
		Hazardous material	Nitrate Mixture will be used for blasting	No storage at mine site, will be imported only at the time of blasting, Basting will be carried out during resting hours, all PPE's will be provided, all care should be taken	No Impact
		Land use & Biodiversity	Blasting	Since this is an existing mine and blasting will be done only to break hard bauxite horizon, no such impacts	Negligible Impacts on land cover
		Air Quality	Generation of dust and fly rock during blasting.	OAL is carrying out blasting in proper manner as indicated in the mining scheme to prevent the problem of fly rock.	Negligible Impact
		Noise & Vibrations	Blasting will lead to the generation of noise and vibrations	As Mewasa village is at ~ 150 m form lease; the blasting pattern is designed to keep the ground vibration to a minimum. Using sequential blasting machine and effective muffling of the holes Short delay in blasting of successive blast holes effectively reduces the vibration problems Use of low velocity of detonation, may minimize the vibration	Negligible Impact
		Energy use	Energy will be used during blasting	-	No Impact
		Visual Impacts	Due to blasting creation of voids and spaces	Blasting will be done to carry out mining and the voids created will be backfilled and used as water reservoir	Negligible Impact

Sr. No.	Stages	Key Issues during Mining	Impacting Activities	Mitigation Measures	Final Impacts
		Safety measures	Blasting	OAL carries out blasting by using well established measures as indicated below: The blast area is identified, cleared and entrances guarded prior to firing shot. Blasting is carried out during the lunch time, so that less number of people present there at that time. Adequate sound signals should be given to posting of guards at strategic position. No dangerous / inflammable articles viz. cigarettes, biddies, match boxes, lighters should be taken or allowed to be taken by the personnel employed for blasting activities. The area surrounding the mixing shed should be kept free from accumulation of inflammable material	No Impact
5	Stacking of Mineral rejects and Handling	Water use & Quality	Not Applicable	-	No Impact
		Wastes	Overburden & waste generates during mining activities	All waste will be backfilled in mined out pits, plantation will be done on backfilled area	Negligible Beneficial Impact
		Hazardous material	Not Applicable	No use of hazardous material	No Impact
		Land use & Biodiversity	Mined out voids with depth of 6.1 m will be generated at the end of mining, Removal of vegetation (mainly spices of Ganda baval)	Voids will be backfilled and use as water reservoir, Plantation will be carried out on backfilled area	Negligible Impact
		Air Quality	Dust emission due to stacking of overburden and waste	OAL plans to backfill the voids simultaneously at the time of waste generation itself	Negligible Impact
		Noise & Vibrations	Not Applicable	-	No Impact

Sr. No.	Stages	Key Issues during Mining	Impacting Activities	Mitigation Measures	Final Impacts
		Energy use	Not Applicable		No Impact
		Visual Impacts	Stacking of overburden and waste	OAL plans to backfill the voids simultaneously at the time of waste generation itself	Negligible Impact
6	Loading	Water use & Quality	Not Applicable	Loading will be manual so no water use	No Impact
		Wastes	Not Applicable	No waste generation take place during manual loading	No Impact
		Hazardous material	Not Applicable	No use of hazardous material	No Impact
		Land use & Biodiversity	Not Applicable	No change	No Impact
		Air Quality	Loading of Bauxite in trucks will create dust emissions	Sprinkling water on muck pile may reduce air pollution. Loading material in dumpers at optimum height to reduce dust blow	Negligible Impact
		Noise & Vibrations	Loading and unloading	Loading will be carried out manually so the noise generation is quite low, and no vibration take place	No Impact
		Energy use	Not Applicable	No use as loading is manual	No Impact
		Visual Impacts	Not Applicable	No change	No Impact
7	Transportation	Water use & Quality	Not Applicable	No water use during transportation	No Impact
		Wastes	Loading & transportation	Efficient loading and unloading procedures, Proper covering of loaded trucks	Negligible Impact
		Hazardous material	Not Applicable	No use of hazardous material	No Impact
		Land use & Biodiversity	Due to movement of vehicles	Since it is an existing mine therefore proper pathways are available for transportation	Negligible Impact
		Air Quality	Transportation of Bauxite from site, vehicles passing on kuccha and pucca roads shall	Covering the loaded trucks to prevent dust pollution	

Sr. No.	Stages	Key Issues during Mining	Impacting Activities	Mitigation Measures	Final Impacts
			create air emissions	Regular water spraying on haulage roads during transportation of material by water sprinklers Leveled roads with less number of turns to reduce air emission	
		Noise & Vibrations	Movement of vehicles at the time of transportation will generate noise	Ensuring all vehicles used for site clearing are well maintained and regularly serviced to minimize emissions in the air. Use of PPE's will be encouraged	
		Energy use	Vehicular movement	-	No Impact
		Visual Impacts	Vehicular movement	Roads for transportation are already exist in the mine	No impact
		Traffic	Transportation activity will somehow increase the traffic in the study area and on haul roads	Maintain record of vehicles All vehicles will be tested for Pollution under Control (PUC) certificate.	No Impact
8	Land Reclamation	Water use & Quality	Collection of rain water in mined out pits	Water will be used for plantation and sprinkling, It is also used by farmers for agriculture purpose	Positive impact
		Wastes	Waste generation, stacking of waste	Waste will be backfilled at the time of its generation	Negligible Impact
		Hazardous material	Not Applicable	-	No Impact
		Land use & Biodiversity	Land degradation due to mining	Land will be backfilled partially and rest will be used as water reservoir	Negligible Impact
		Air Quality	Mining and transportation activities	Plantation will help in increasing the air quality in the area.	Negligible Beneficial Impact
		Noise & Vibrations	Not Applicable	-	No Impact
		Energy use	Not Applicable	-	No Impact
		Visual Impacts	Land degradation due to mining and blasting	Backfilling will be carried out and plantation will be	Negligible

Sr. No.	Stages	Key Issues during Mining	Impacting Activities	Mitigation Measures	Final Impacts
				done, rest will be used as water reservoir	Beneficial Impact

The total cost of the project is provided in ***Table 5***.

Table 5: Cost of the Project

Capital Expenditure				Operational Expenditure			
S. No.	**Item**	**Cost (INR)**	**Remarks**	**S. No.**	**Item**	**Cost (INR)**	**Remarks**
1.	Mining lease application and approval	3,500		1.	Cost of mining	7,72,38,000	
2.	Lease area demarcation	2,06,400		2.	Royalty	3,31,02,000	
3.	Acquisition of lease hold rights from private land owners on which the ML has been granted	NIL	No private land is involved	3.	Transportation	10,04,09,400	
4.	Mining plan preparation and approval	80,500		4.	Sorting & sizing	96,54,750	
5.	Mines development expenses including approach road construction	36,000		5.	Truck Loading	1,10,34,000	
6.	Civil works including site office and staff quaters	2,25,000		6.	EMP	10,06,500	
7.	Weighbridge and its mechanical installation and civil works	20,23,055	Common weigh bridge installed for group of mines of OAL in Mewasa, Virpur and Ran Villages	7.	Others	2,00,000	
8.	EHS Permits and compliance related studies	30,00,000					
9.	Heavy earthmoving quipment, crusher, vibrating screens and D.G. Set and allied machinery	-	Mechanical equipment will be hired from market only				
10.	Tools and tackles including GPS	15,000	For group of mines				
11.	Vehicles	-	Common vehicle would be provided for group of mines				
12.	Misc. expenses	65,000					

Capital Expenditure				Operational Expenditure			
S. No.	**Item**	**Cost (INR)**	**Remarks**	**S. No.**	**Item**	**Cost (INR)**	**Remarks**
13.	Margin money for working capital	-	Common money will be kept for group of mines.				
	Total	**56,54,455**			**Total**	**23,26,44,650**	

1.6 Risk Assessment and Disaster Management Plan

The methodology for the risk assessment has been based on the specific risk assessment guidance issued by the Directorate General of Mine Safety (DGMS), Dhanbad, vide Circular No.13 of 2002, dated 31st December, 2002.

1.6.1 Hazard Identification

The identification of hazards has been done considering operations

1.6.2 Risk Assessment

On the basis of the above scoring format of DGMS, and after a perusal of the resultant scores, professional judgment was exercised in selecting the following scale for assessing risk levels:

Level 1: > 15; i.e., requiring immediate action
Level 2: <15 but > 5; i.e., requiring management action
Level 3: < 5; i.e., low risks requiring periodic review

In some cases personnel are only exposed to the hazard for part of the time. Hence, the more detailed analysis of the risk ranking can be carried out by taking exposure (% time personnel are present) and probability (chance that they will be harmed) into consideration. Thus:

Risk Score = (Probability x Exposure) x Consequence

1.6.3 Hazard Analysis

The hazards cover explosive material management, working at heights, slope and bench stability, mineral transport, mineral processing and force majeure conditions (rainfall & flooding). Risk level 1 and risk level 2 are taken into consideration.

1.6.4 Control and Action Plans

To ensure that causes leading to the possible consequences are prevented from occurring, control and action plans are developed and suggested and discussed in greater details in section 6.6.

1.6.5 Disaster Management Plan

- The DMP is supposed to be a dynamic, changing, document focusing on continual improvement of emergency response planning and arrangements. A structure working on a Plan, Do, Check & Review (PDCR) cycle has been therefore suggested.
- The Environment, Health, and Safety (EHS) policies are to be made accessible to all at site and to other stakeholders.
- Possible emergency situations can broadly be classified into unintended explosions, vehicle collision, and inundation.
- Responsibilities, resources, and timeframes are allocated for implementing the objectives.
- Assembly points, liaison with state authorities, task force of essential staff, emergency control center, fire fighting etc. are discussed.

Treatment of affected persons

- Injured / Affected persons shall be provided suitable first-aid treatment and sent to Co.'s Doctor for further treatment depending on injury.
- Patients requiring further treatment shall be sent in Ambulances to Hospitals in Jamnagar

- Patients suffering from minor problems shall be discharged and sent home after preliminary treatment

Training

Regular training of all concerned personnel will be conducted to enable the Staff to face any type of Emergency be it Natural Disaster, Fire in Equipment, Building or any explosion in quarry.

DMP Audit, Non Conformance and Corrective Action and Preventive Action

Since this DMP has been designed as a dynamic document, it is required that its performance be audited at regular intervals. Ideally, persons auditing the DMP should be external auditors (i.e. not employed at the site being audited). Audits will be periodic, at intervals that are decided by the Head Office.

Review of Emergency Performance

On the basis of these, the management will record its decisions and consider modifying the DMP, as deemed appropriate.

1.7 Conclusions

- No prominent watercourses or nallah are in the leases.
- The impact on ambient air quality due to proposed activities will be within acceptable norms. Efforts are required to ensure that the mine road passing through Ran Village is made pucca to reduce generation of dust along that road.
- Noise pollution is mainly due to operation of blast hole drilling, blasting and occasional plying of trucks. These activities will not cause any problem to the inhabitants of this area because there is no human settlement in close proximity to the lease area.
- Rainwater obtained during mining will be collected in mined out pits which will than used for dust suppression. As OAL will not dispose off mine drainage in surface water bodies there is no negative impact on surface water bodies.
- There is no habitation in the mining leases. Mining in these leases will give job opportunities to the local people. Several persons of the neighboring villages have been benefited with contract works, employment through contractors, running jeeps, trucks, tractors, and buses on hire, running canteens, different kind of shops and transport related business avenues. Villagers get other welfare amenities such as drinking water, foods, shed etc.

1.7.1 Environmental Assessment and Suitability of the Proposed Development

The mining activity will always result in some form of negative impact on the environment, whether impacts are mitigated or not. The idea is to match the environmental, social, and economical issues to such an extent that the overall outcome of an activity will not result in a combined lesser value for these three issues. The economic benefit and potential social up-liftment of the proposed mining project should outweigh the environmental impacts addressed in this report, through the implementation of the mitigation measures, to result in an overall positive value for the combined environmental, social, and economic issues.

It can be concluded on a positive note that after the implementation of the mitigation measures and Environmental Management Plan, activities of OAL's mine during the mining phase would have negligible impact on environment.